

5.0 Cleanup Standards

Ecology is the lead agency responsible for selecting site-specific cleanup levels, cleanup areas, and cleanup actions related to PCBs in the Spokane River. The standard Ecology Sediment Management Standards/Model Toxics Control Act (SMS/MTCA) framework was used to designate PCB removal and cleanup areas. Under MTCA, cleanup standards include three components: 1) cleanup levels; 2) points of compliance; and 3) applicable or relevant and appropriate requirements (ARARs). Potential cleanup levels and associated points of compliance were developed for the Site following MTCA Cleanup Regulations (WAC 173-340). MTCA Method B procedures employ a risk-based evaluation of potential human health and environmental exposures to Site contaminants. Cleanup levels must be protective of wildlife inhabiting the Site and must account for health risks associated with consuming fish and shellfish. Since PCBs bioconcentrate, cleanup levels must be set at a level that will not result in the accumulation of PCBs in fish tissue above levels known to cause a maximum one in a million lifetime cancer risk to humans. As defined in the MTCA regulation, cleanup levels must also be at least as stringent as established state or federal standards or other laws (i.e., ARARs) developed for human health and environmental protection.

5.1 Applicable Federal, State, and Local Laws

Many environmental laws may apply to this cleanup action. In addition to meeting MTCA cleanup standard requirements, cleanup actions will also meet the environmental standards set forth in other applicable laws. Though a cleanup action performed under formal MTCA authorities (e.g., a Consent Decree) is exempt from the procedural requirements of certain state and local environmental laws, the action must nevertheless comply with the substantive requirements of such laws. Potentially applicable federal, state, and local laws that may impact the implementation of remedial actions at the Site are provided below in accordance with WAC 173-340-710. A more detailed summary of potentially applicable federal and state regulation has been provided in the Upriver Dam PCB Site Feasibility Study, 2005. Selected cleanup actions will meet the substantive requirements of all applicable local, state, and federal regulations. Site-specific requirements will be discussed and accounted for in the forthcoming Upriver Dam PCB Site Engineering Design Document.

5.1.1 Federal Requirements

Potential federal requirements are specified in several statutes, codified in the US Code (USC), and regulations promulgated in the Code of Federal Regulations (CFR), as discussed in the following sections.

The Clean Water Act (CWA) (33 USC Section 1251 et seq.) requires the establishment of guidelines and standards to control the direct or indirect discharge of pollutants to waters of the United States. Cleanup levels at this Site will provide a level of protectiveness that meets or exceeds the EPA's Water Quality Criteria for PCBs published in accordance with Section 304 of the CWA (33 USC 1314).

Discharges of Pollutants into Navigable Waters are regulated under Sections 401 and 404 of the CWA (33 USC 1341 and 1344), 40 CFR Part 230 [Section 404(b)(1) guidelines], 33 CFR Parts 320 (general policies), 323 and 325 (permit requirements), and 328 (definition of waters of the United States). These requirements regulate the excavation of shoreline materials and the

placement of fill material (including caps) below the ordinary high water elevation of waters of the United States.

5.1.2 Washington State and Local Requirements

MTCA (Chapter 70.105D RCW) authorized Ecology to adopt cleanup standards for remedial actions at sites where hazardous substances are present. The processes for identifying, investigating, and cleaning up these sites are defined and cleanup standards are set for groundwater, soil, surface water, and air in WAC 173-340. The levels for cleanup of contaminated sediments must be stringent enough to prevent cross-media contamination. Site-specific cleanup levels are determined on a case-by-case basis while meeting the intent of the Sediment Management Standards (WAC 173-204).

In addition to MTCA, potential state requirements are specified in several statutes, codified in the Revised Code of Washington (RCW), and regulations promulgated in the WAC.

Washington Sediment Management Standards (WAC 173-204). The SMS sets forth a sediment cleanup decision process for identifying contaminated sediment areas and determining appropriate cleanup responses. The SMS governs the identification and cleanup of contaminated sediment sites and establishes two sets of numerical chemical guidance against which surface sediment concentrations are evaluated. The more conservative sediment quality standard (SQS) provides a regulatory goal by identifying surface sediments that have no adverse effects on human health or biological resources.

State Environmental Policy Act (SEPA) (43.21C RCW; WAC 197-11). The SEPA is intended to ensure that state and local government officials consider environmental values when making decisions or taking an official action such as issuing a MTCA Cleanup Action Plan.

Washington Water Pollution Control Act (Chapter 90.48 RCW; WAC 173-201A). The Water Pollution Control Act provides for the protection of surface water and groundwater quality. WAC 173-201A establishes water quality standards for surface waters of the state.

Washington Shoreline Management Act (Chapter 90.58 RCW; WAC 173-14). The Shoreline Management Act and regulations promulgated there under establish requirements for substantial developments occurring within water areas of the state or within 200 feet of the shoreline.

Washington Hydraulics Code (Chapter 75.20 RCW; WAC 220 110). The Washington Hydraulics Code establishes requirements for performing work that would use, divert, obstruct, or change the natural flow or bed of any salt or fresh waters. Shoreline excavation, dredging, and/or capping actions would likely be required to meet the substantive requirements of a Hydraulic Project Approval (HPA) permit under this state regulation.

5.2 Cleanup Levels Considered

Developing cleanup levels involves several steps: determining what substances contribute to overall risks at the site (indicator hazardous substances or contaminants of concern); evaluating concentrations of single hazardous substances in single media (e.g., sediment) to select indicators; determining which method to use; determining the reasonable maximum exposure scenario; developing cleanup levels for individual substances in individual media, taking into account potential cross-media contamination; and, adjusting individual concentration levels downward to meet site total cancer risk and hazard index limits specified in MTCA. See, WAC 173-340-700.

Based on the RI data for the Upriver Dam impoundment area, the chemicals of potential concern within sediments investigated at the Site are PCBs, cadmium, lead, zinc, total organic carbon (TOC) and retene. As discussed in Section 3.4, the widespread heavy metal contamination at the Site is addressed under the EPA's ROD for the Spokane River. This FCAP is directed towards a subset of areas (Deposits 1 & 2) within the Site which have elevated levels of PCBs. However, in the context of developing appropriate cleanup levels and response actions that address PCBs at the Site, consideration was given to the potential risks and cleanup remedies applicable to the other hazardous substances found at the Site. The selected cleanup actions will remediate the Site's PCB-contaminated sediments while also incidentally effectively reducing risks posed by the co-located COPCs in Deposits 1 and 2.

Cleanup levels for the Site were developed pursuant to the MTCA Cleanup Regulation Method B procedures, taking into account the potential for cross-media transport. Method B employs a risk-based evaluation of potential human health and environmental exposures to site contaminants.

The Method B cleanup level for one medium must be protective of the beneficial uses of other affected media. For example, since sediment porewater could potentially contribute to surface water PCB flux at the Site, sediment cleanup levels need to consider surface water protection requirements. In turn, these surface water requirements and corresponding sediment concentrations must be stringent enough to prevent the excessive accumulation of PCBs in fish tissues and groundwater in order to be considered protective of human health. Sediment cleanup standards, groundwater criteria, and surface water protection considerations are discussed separately in the sections below.

5.2.1 Surface Water Protection Criteria

The MTCA Method B surface water cleanup level considers WAC 173-201A requirements, as well as federal Clean Water Act aquatic life and human health criteria, National Toxics Rule aquatic life and human health criteria (40 CFR 131.36), federal Drinking Water Standards and Health Advisories, and the State Primary Drinking Water Regulations (WAC 246-290). Human health risk calculations for reasonable maximum surface water exposures (including bioaccumulation and drinking water pathways) were performed using the standard MTCA Method B risk equations.

In accordance with MTCA requirements, Method B cleanup levels for the protection of surface waters, supporting fish or shellfish, were calculated for known or suspected carcinogens using MTCA Equation 730-2 (WAC 173-340-730) which accounts for cancer risks associated with

dietary exposure to PCBs and the propensity of PCBs to concentrate in fish tissues. Using a bioconcentration factor of 31,200 L/Kg, and a cancer potency factor of 2 mg/Kg-day, a maximum surface water PCB concentration objective of 104 pg/l is estimated to lower the risk of fish consumption to an acceptable level.

Consistent with the summary provided in Ecology's current Cleanup Level and Risk Calculation (CLARC) tables, version 3.1, Method B surface water level ARAR for PCBs is based on WAC 173-201A and current National Toxics Rule ARAR for human health protection of 170 pg/L. Also note that EPA's 2002 ambient water quality standard for the protection of aquatic life from chronic PCB exposure (14,000 pg/L), as well as the drinking water maximum contaminant level (500,000 pg/L), are both considerably less stringent than the bioaccumulation-based Method B cleanup level.

While the current National Toxics Rule surface water quality criterion of 170 pg/L provides one basis for developing the Method B cleanup level, Ecology is using a second value that applies as the MTCA surface water quality cleanup level at the Upriver Dam PCB Site. That is, EPA (2002) recommends that the surface water quality criterion for PCBs be lowered to 64 pg/L, and this value may be used under MTCA as the Method B cleanup level (WAC 173-340-730[3][b][i][B]). For the purposes of this FCAP the more conservative of these values (i.e., 64 pg/L) was set as the cleanup level for the surface water and was the basis for evaluating prospective remedial action requirements at the Site.

5.2.2 Sediment Cleanup Levels Required to Protect Surface Water

Cleanup levels identified for one medium also need to be protective of other affected, or potentially affected, media. Thus, the selection of sediment cleanup levels needs to consider surface water protection requirements, among others. For the purpose of supporting a comparative evaluation of the protectiveness of alternative remedial actions within the Site (see Section 6), sediment porewater PCB concentrations at a depth of 10 cm below the mudline were estimated and compared with the 64 pg/L criterion recommended by the EPA. Since SMS recognizes the sediment/water interface at the mudline and the PCB-containing sediments continue gradually to be buried by cleaner sediments, the 0-10 cm depth represents a conservative point of release into the overlying water column. Three-phase equilibrium partitioning (EqP) was used to determine potential sediment cleanup levels (WAC 173-340-747, Equation 747-1). Two iterations of the 3-phase EqP model were run for the sediments in the Upriver Dam PCB Site. The model was run using both the generalized equilibrium coefficient [Koc] for total PCBs and a site-specific Koc value, which accounts for the proportion of individual PCB-congeners found on-site. Specifically, the 3-phase EqP model was utilized to determine a range of sediment cleanup levels that are protective of surface water and human health as demonstrated by meeting: (1) National Toxics Rule (NTR) criteria and; (2) Method B requirements for surface water PCB concentrations equated with a 1×10^{-6} maximum lifetime cancer risk associated with the consumption of contaminated fish and shellfish.

National Toxics Rule Criteria - Based on detailed core profiling data for PCBs and total organic carbon (TOC) available for the Site, the EqP model was run using a generalized equilibrium partitioning coefficient [Koc] for total PCBs of 822,422 liters per kilograms [L/Kg]. Using the generalized Koc value from the CLARC tables - version 3.1, the Method B EqP model and the National Toxics Rule criteria for human health protection of 170 pg/L, a protective sediment cleanup level of 228 μ g/Kg is calculated. Similarly, a protective surface sediment cleanup level

of 86 µg/Kg is calculated based on the 64 pg/L recommended criteria ARAR for surface water protection.

In addition, a more site-specific evaluation of pore water contamination potential was also deemed appropriate by Ecology for the Site based on extensive chemical profiling of the sediment performed during the RI. A site-specific Koc of 457,088 L/Kg, based on the proportion of various PCB congeners found on-site, was used to calculate potential sediment cleanup levels for the Site. Based on the current National Toxics Rule ARAR for human health protection of 170 pg/L, the EqP model indicates a maximum advisable concentration of PCBs in surface sediment at 127 µg/Kg. A maximum sediment concentration of 48 µg/Kg is calculated to satisfy the recommended 64 pg/L surface water criteria, based on this modeling. Estimated porewater concentrations near the sediment surface (i.e., at a depth of 10 cm below the mudline at Deposit 1) currently range from approximately two to three orders of magnitude above the 64 pg/L criterion. Thus sediment deposits at the sediment surface and deeper are a likely source of PCBs to the overlying water column and an appropriately protective cleanup level based on the NTR criterion is between 48 µg/Kg and 228 µg/Kg.

MTCA Method B Surface Water Cleanup Level – Surface sediment (0-10cm) PCB cleanup concentrations to assure protection based on the Method B human health fish consumption assumptions were also calculated using both a generalized Method B Koc and Site-specific Koc values of 822,422 and 457,088 L/Kg, respectively. Using the standard three equilibrium partitioning model described by MTCA's Equation 747-1 and the generalized Koc value, maximum surface sediment concentrations of 140 µg/Kg are appropriate to maintain surface water PCB concentrations at a level where PCBs in fish tissue would not pose an unacceptable risk to human health (WAC 173-340-747). Similarly, the site-specific Koc indicates that maintaining surface sediment concentrations below 78 µg/Kg would reduce the risks associated with eating fish and/or shellfish exposed to PCBs at the surface water/sediment interface. Thus, Method B sediment/pore water calculations indicate that sediment levels ranging from 78 to 140 µg/Kg are protective of consumers of fish. This supports the use of the EPA recommended surface water criterion (64 pg/L) which is also designed to be protective of human health.

5.2.3 Sediment Cleanup Levels Required to Protect Groundwater

Ecology considered three criteria in the selection of sediment cleanup levels required for the protection of the Site's groundwater (Table 1). The selected sediment cleanup level must be protective of the most stringent criteria set by state and federal drinking water ARARs. Under MTCA Method B, groundwater PCB concentrations must be below 0.044 µg/L in order to maintain a 1x10⁶ lifetime cancer risk (CLARC Version 3.1, Table 720-1). The state and federal drinking water maximum contaminant level of 0.5 µg/L exceeds MTCA risk requirements. Ecology's cleanup levels must ensure that affected groundwater remains below the 0.044 µg/L criterion as determined by Method B evaluation for carcinogens. Sediment deposits at the Site do not pose an appreciable risk to area groundwater based on the: site conceptual model, PCB concentrations in the sediments, observed PCB concentrations in groundwater, and the propensity for PCBs to bind to organic matter.

5.2.4 Sediment Cleanup Levels Required to Protect Aquatic Life

MTCA addresses sediment cleanup levels by reference to the Sediment Management Standards (SMS). Under the SMS, the primary endpoint for sediment quality evaluations is protection of

the environment, specifically the benthic community within the biologically active zone (0 to 10 cm), from adverse effects associated with contaminants. Numeric freshwater sediment quality values (SQVs) for a range of chemicals are still under development by Ecology, though interim guidelines have been released based on probable or apparent effects thresholds (AETs) calculated using the available regional database of synoptic chemistry and toxicity test information (Michelsen 2003). While SMS cleanup levels have been promulgated for sediments in the marine environment, freshwater sediment cleanup levels are currently determined on a case-by-case basis (WAC 173-204-340).

Sediment quality screening values considered in this decision document included the following:

1. Potential for localized toxicity to benthic invertebrate organisms based on Ecology's most recent evaluation of SQVs for use in its freshwater sediment management programs, including updates of existing freshwater AETs and evaluations of other SQV measures that may provide improved reliability. Ecology is currently considering potential freshwater toxicity-based SQVs ranging from 62 $\mu\text{g/Kg dw}$ (lowest AET) to 354 $\mu\text{g/Kg dw}$ (second lowest AET). Although site-specific bioassays can be performed to provide a more direct assessment of sediment toxicity, at the Upriver Dam PCB Site this is complicated by the presence of co-occurring metal and wood waste contaminants.
2. Potential risks to wildlife and human health due to PCB uptake and bioaccumulation – Detailed bioaccumulation studies at other freshwater and marine PCB sites have evaluated average surface sediment concentrations across the characteristic home range of the resident biota. Representative applications of sediment bioaccumulation modeling at certain other sediment PCB cleanup sites have resulted in bioaccumulation-based SQVs ranging from approximately 320 to 1,000 $\mu\text{g/Kg dw}$ (Anchor, 2004). For this FCAP, the more conservative guideline SQV presented above (i.e., 62 $\mu\text{g/Kg dw}$) was used as the basis for delineating remedial action areas at the Site. MTCA risk assessments, based on the EPA's recommended water quality criterion of 64 pg/L , validate the updated LAET levels of 62 $\mu\text{g/Kg}$ for PCBs in sediments, as derived by Ecology for the protection of aquatic life (Michelsen, 2003).

5.3 Selection of Site-Specific Sediment Cleanup Level

For the Upriver Dam PCB cleanup, Ecology has determined that a cleanup level of 62 $\mu\text{g/Kg}$ total PCBs in sediment will be protective of human health, the river ecological community, and is supported by interim benthic protection guidelines, analytical porewater partitioning calculations at the sediment /surface-water interface, as well as ground and surface water quality protection levels. This cleanup level has been applied to the selection of remedies for the Site.

The selected sediment cleanup level is based on the lowest AET suggested for use in freshwater sediments. The methodology for determining sediment AET levels is well established and has been utilized by the state of Washington and the EPA in determinations of SQVs. While this value is derived for protection of aquatic life inhabiting the upper layer (0 - 10 cm) of the sediment, the cleanup level of [62 $\mu\text{g/Kg dw}$] is also protective of human health. A summary of criteria and guidelines considered in the selection of sediment cleanup levels at the site is provided in Table 2.

Criteria Evaluated in the Selection of Sediment Cleanup Level for the Spokane River Upriver Dam PCB Site	Calculated or Established Concentration Limits for PCBs in Water	Sediment Concentrations to Meet Standards or Criteria
Criteria For Surface Water Protection		
National Toxics Rule (NTR) Criterion	170 pg/L	228 µg/Kg *
EPA 2002 recommended Water Quality Criterion	64 pg/L	86 µg/Kg *
MTCA Method B Evaluation for Carcinogens	104 pg/L	140 µg/Kg *
Ambient Water Quality for Protection of Aquatic Life		
Ecology's Acute Criterion	2.0 µg/L	1644.8 mg/Kg *
Ecology's Chronic Criterion	0.014 µg/L	11.5 mg/Kg *
Groundwater Protection Criteria		
MTCA Method B Evaluation for Carcinogens	0.044 µg/L	36 mg/Kg *
Maximum Contaminant Level (WAC 246-290-310)	0.5 µg/L	411 mg/Kg *
MTCA Method A Criterion	0.1 µg/L	82.2 mg/Kg *
Ecology's Guidelines For Protection of Sediment Species		
MTCA Sediment Quality Value (SQV)	62 µg/Kg – Ecology's Selected Cleanup Level	

Table 2. Criteria and guidelines used to set sediment PCB cleanup levels. (* EqP Estimated sediment cleanup standards)

Ecology believes the selected cleanup level of 62 µg/Kg will prevent fish from accumulating excessive PCBs from the Site's sediments. The value also is protective of both human health and aquatic life inhabiting the upper biologically active area of the sediments. As discussed above, a three-phase partitioning model was utilized to estimate sediment concentrations which would meet criteria MTCA objectives, and ARARS. The sediment cleanup level also is protective of national surface water quality recommendations [i.e., 64 pg/L] for the protection of human health. The 62 µg/Kg sediment cleanup level set by this decision document is as stringent as established state or federal standards or other laws (i.e., ARARs) developed for human health and environmental protection.

5.4 Point of Compliance

MTCA defines the point of compliance as the point or points where cleanup levels established in accordance with WAC 173-340-720 through 173-340-760 shall be attained. Once those cleanup levels have been attained the site is no longer considered a threat to human health and the environment.

The SMS default point of compliance for sediment and surface water cleanup levels is the 0 to 10 cm depth interval below the mudline. Radioisotope dating evaluations support that the biologically active zone in the contaminated sediments does not extend below the 10 cm interval, and in several cores is limited to the 0 to 4 cm interval. Existing sediment contamination at the Site (i.e., metals, PCBs, and possibly wood waste) may potentially limit the effective depth of biologic activity. Use of a default 0 to 10 cm point of compliance in the sediment cleanup level provides an additional level of protectiveness to address potential future improved conditions at the Site.

Pursuant to MTCA, the point of compliance for documenting protection of human health and the environment resulting from potential surface water exposures is at the sediment/water interface

and throughout the water column of the Spokane River (WAC 173-340-730(6), (7)). Consistent with MTCA and the selected cleanup level, PCB concentrations at the sediment/water interface below 62 µg/Kg are not considered a threat to human health or the environment for this cleanup. Under MTCA, the point of compliance for the protection of human health and the environment resulting from potential surface water exposures must also consider the point of release of sediment porewater into the Spokane River (i.e., at the sediment-surface water interface or mudline). As stated previously, EqP modeling of PCBs between bulk sediment and porewater, along with diffusion of PCBs into the overlying surface water at the mudline, indicates that a surface (0 to 10 cm average) sediment cleanup level of 62 µg/Kg will maintain porewater concentrations at the mudline below the recommended criteria of 64 pg/L. Thus, the sediment cleanup level and associated point of compliance provides for appropriate surface and groundwater protection.